

SEAT No. \_\_\_\_\_

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[83]

## Sardar Patel University

Vallabh Vidyanagar - 388120

B.Sc. [Semester- V] Subject: Applied Physics

Course Code No: US05CAPH23

Course Title: Solid State Physics

Monday, Date 26-12-2020

Time: 2 pm to 4 pm

Total Marks-70

Q1 Multiple Choice Questions: [Attempt all] [10 Marks]

- 1 There are \_\_\_\_\_ Bravais lattice in a tetragonal crystal system.  
(a) 1 (b) 2 (c) 3 (d) 4
- 2 The Zinc has \_\_\_\_\_ structure.  
(a) BCC (b) FCC (c) DC (d) HCP
- 3 Number of particles in a primitive cubic unit cell is:  
(a) 1 (b) 2 (c) 3 (d) 4
- 4 The Madelung constant for Zinc Blende structure is  
(a) 0.63 (b) 1.63 (c) 2.63 (d) 3.63
- 5 \_\_\_\_\_ bond comes to existence due to sharing of electrons.  
(a) Covalent (b) Hydrogen  
(c) Ionic (d) None of these
- 6 Lorentz extended Drude model and thus extended classical model is \_\_\_\_\_.  
(a) Drude-Hendrik model (b) Drude-Sommerfeld model  
(c) Drude-Lorentz model (d) Lorentz model
- 7 If  $\lambda$  is the mean free path between the collisions of a free electron, the average time between collisions is  
(a)  $T = \lambda/v_F$  (b)  $T = v_F/\lambda$  (c)  $v_F = I \times R$  (d) All correct
- 8 Phase space is a \_\_\_\_\_ dimensional space.  
(a) 2 (b) 4 (c) 6 (d) 8
- 9 Which of the following semiconductor has a direct band gap?  
(a) Ge (b) Si (c) GaAs (d) All of these
- 10 The name of the point at the center of the Brillouin zone for a diamond lattice is called:  
(a) X (b) L (c) K (d)  $\Gamma$

**Q2 Answer any TEN questions in short.**

**[20 Marks]**

- (1) Define unit cell.
- (2) Define crystal symmetry.
- (3) Differentiate between point group and space-group symmetry.
- (4) Draw the three-dimensional lattice of NaCl structure.
- (5) Explain Hydrogen bond.
- (6) Give any two properties of metallic crystals.
- (7) Write only assumptions for the Drude model for free electrons gas.
- (8) State Wiedemann-Franz law.
- (9) Discuss number of electron per energy interval at  $T = 0$  K.
- (10) Explain k-space.
- (11) State Bloch theorem.
- (12) Define Forbidden energy gap.

**Q3 Fill in the blanks using the words given in the bracket.**  
**[8 Marks]**

- (1) Coordination number for an ideal BCC metallic crystal is \_\_\_\_.
- (2) Iron has a non-crystalline structure. [True/False]
- (3) Covalent bond is an example of a \_\_\_\_\_ bond. [Primary/Secondary]
- (4) The Madelung constant for NaCl structure is 2.75. [True/False]
- (5) The free electrons collide with the lattice elastically. [True/False]
- (6) The simplest analysis of the Drude model assumes that the thermal velocity of electrons is \_\_\_\_\_. [high/low]
- (7) Dielectric constant for most polymers lies in the range of \_\_\_\_.  
[2-5/ 4-7]
- (8) Lead Zirconate is an example for piezo-electric material.  
[True/False]

**Q4 Attempt any FOUR long Questions.**

**[32 Marks]**

- (1) Explain SC crystals structure and determine APF.
- (2) Explain FCC crystal structure and determine APF.
- (3) Discuss the cohesion of atoms and derive the equation for cohesive energy.
- (4) Write a note on the lattice energy of ionic crystals.
- (5) Write a note on the Thermal conductivity of metals.
- (6) Discuss the Fermi-Dirac distribution function.
- (7) Write a short note on the density of the state.
- (8) Write a note on the origin of the energy gap for a band structure.

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